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EFFECTS OF YOGA ON COGNITIVE FLEXIBILITY, LOCUS OF CONTROL AND EMOTION REGULATION OF IT PROFESSIONALS

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EFFECTS OF YOGA ON COGNITIVE FLEXIBILITY, LOCUS OF CONTROL AND EMOTION REGULATION OF IT PROFESSIONALS

CHAPTER I

INTRODUCTION

Background

IT professionals across the world work long and erratic hours at an unsustainable pace, usually across different time zones. Its lifestyle is characterized by occupational stress, fast-paced working environment, ergonomic hazards, and failure to achieve and maintain a healthy work-life balance. Despite big salary packages and high social status, their health scenario is worrisome. Their well-being and health scenario has become worrisome, affecting their performance and productivity (Pinto & Ulman, 2004; Telles, Dash, & Naveen, 2009; Raja & Bhasin, 2014; Ralph et al., 2020).

A well designed and executed workplace health promotion programs can impact employees' long-term lifestyle choices, improve psychological and physical health, reduce absenteeism, sick leaves and accidents, improve employee morale and increase employee productivity. Workplace yoga can have numerous benefits for the working professionals, especially as it alleviates and removes stress related problems that the majority of today's workforce experiences, helps employees to keep body flexible and healthy and teaches how to lead a healthy and happy life "off the mat". Though yoga has emerged as a popular and scientifically proven set of tools for addressing those issues, still many aspects have been understudied.

Significance of the study

The current study focused on effectiveness of yoga on selected psychological and occupational health and well-being variables. As per researcher's best knowledge, most of these relationships had been less researched, especially in the population of IT professionals in India. This makes the study unique, as it brings to the light new knowledge and fills the existing gaps. This study provides heuristic evidence on the effects of yoga on cognitive flexibility, locus of control and emotion regulation, as co-primary variables, in Indian IT professionals.

CHAPTER II

REVIEW OF CLASSICAL LITERATURE

This chapter presents the ancient Indian scriptures, that are primarily meant for spiritual growth of a person, and also present many sound advices on how to lead a happy and healthy life, how to avoid stress, keep the mind still and work in the most efficient manner.

A review of classical Indian scriptures is presented in a simple manner, under categories that are directly connected to the main research area. The main goal is to understand the concept of stress, mind, work and other concepts, and their management according to *Bhagavad Gita*, *Pātañjalayogasūtra* and other traditional Indian texts, and to connect the ancient wisdom with today's modern research findings.

According to *Bhagavad Gita* (2.62, 2.63) (Mukundananda, 2020) "While contemplating on the objects of the senses, one develops attachment to them. Attachment leads to desire, and from desire arises anger." And then "Anger leads to clouding of judgment, which results in bewilderment of the memory. When the memory is bewildered, the intellect gets destroyed; and when the intellect is destroyed, one is ruined." Furthermore, "You have a right to perform your prescribed duties, but you are not entitled to the fruits of your actions. Never consider yourself to be the cause of the results of your activities, nor be attached to inaction." (BG, 2.47). According to *Pātañjalayogasūtra* (Pradīpaka, 2020): "Correct knowledge (pramāṇa), false knowledge (viparyaya), verbal knowledge about something that is nonexistent (vikalpa), (deep) sleep (nidrā) and recollection --smṛti-- (smṛtayaḥ) (are the five modifications of mind)" (PYS, 1.6).

CHAPTER III

REVIEW OF SCIENTIFIC LITERATURE

This chapter deals with scientific publications on the topic of effectiveness of yoga on psychological and occupational health and well-being. The goal was to identify both the lacunas and hot trends in the current research, and formulate study's aims and objectives accordingly.

Firstly, a bibliometric analysis of yoga in occupational settings presents the findings about the key journals that have published papers on yoga in occupational settings, the most prolific authors, 10 most cited publications and the key concepts on yoga in occupational settings that have been explored by scholars. The main findings show that countries that had the closest collaboration with other countries are India, Germany, Australia and the Netherlands. The journal with the most total citations was *Scandinavian Journal of Work, Environment and Health*. The most prolific author was Dr. Nagendra, H.R., affiliated to S-VYASA University, Bangalore, India, whereas the most cited articles were published by the research team Proper, K.I., Strijk, J.E. and van der Beek, A.J., affiliated to the TNO-VUmc, Amsterdam, Netherlands. The key concepts in the research on yoga in occupational settings, besides COVID-19, were stress, quality of life and anxiety; workplace, spirituality, karma yoga and Bhagavad Gita; mindfulness, meditation, employee wellness; physical activity and exercise.

Secondly, psychological and occupational health and well-being constructs used in the study are explored into more details, with the aim of highlighting the present research scenario and exploring the findings beneficial for the population of IT professionals. Cognitive flexibility was declared as one of the top 10 key skills for software developers and analysts for the year 2020 (Voitenko and Gadasina, 2017), as the employees with greater COFL adopt to new, fast-moving IT technologies faster than the rest of the workforce. Meditation and mindfulness improve mental balance, especially attentional and cognitive aspects, and along with conative and affective aspects improve the overall well-being (Moore & Malinowski, 2009). Simplified Kundalini Yoga along with meditation improves internal LOC (Suresh, Ramachandran and Jayachander, 2013). The practice of yoga has a positive impact on emotion regulation (Daly, Haden, Hagins, Papouchis, & Ramirez, 2015). According to Menezes, Kiesow, Sperb & Hertzberg (2015), long term yoga practitioners use

cognitive reappraisal more often than participants practicing yoga for a shorter duration. They found that emotion regulation enhancement can be a hypothetical mechanism through which yoga and mindfulness influence psychological health and well-being. Furthermore, yoga may be able to foster emotion regulation skills through such mechanisms as reappraisal, attention regulation, self-monitoring, self-awareness, and autonomic regulation. Highly engaged workforce puts more efforts in the assigned work, is more creative and innovative, and shows more initiative at the workplace (Sharma & Nambudiri, 2020). Employee should also detach or disconnect from work mentally and only physically be away from the working environment (Querstret & Cropley, 2012). According to Raja & Bhasin (2014), in a study conducted in India, sleep disorders were common among 83% of call center employees, as compared with Information Technology enabled Services (ITeS) industry average of 39.5%. It has been found in various studies that yoga improves sleep quality (Kanchibhotla, Parekh, Harsora, & Kulkarni, 2021; Kepenek-Varol, Zeren, Dinçer, & Erkaya, 2022).

The final part explores the lacunas in literature research and sets the goals for the study. To the best of researcher's knowledge there is no known study reporting the effect of yoga, pranayama and/or meditation on cognitive flexibility, locus of control, emotion regulation in IT professionals in India. Thus, the goal of the present study is to study the effects of yoga-based intervention and cognitive flexibility, locus of control, emotion regulation, as co-primary variables, in the population of IT professionals in India.

CHAPTER IV

AIMS AND OBJECTIVES

Aims of the study are:

- To study the effects of selected yogic practices on cognitive flexibility, locus of control and emotion regulation of IT professionals
- To study the effects of selected yogic practices on work engagement, work-related rumination and sleep quality of IT professionals

Objectives of the study are:

- To evaluate the effects of selected yogic practices on cognitive flexibility, locus of control and emotion regulation of IT professionals
- To evaluate the effects of selected yogic practices on cognitive flexibility, locus of control and emotion regulation of IT professionals in terms of difference in gender and age
- To evaluate the effects of selected yogic practices on work engagement, work-related rumination and sleep quality of IT professionals

This quantitative study addressed the following research questions and hypotheses:

RQ1: Is there a difference in Cognitive Flexibility (COFL) after implementing the 12-week yoga-based intervention, as measured by the CFI, between the yoga and control groups over time?

> **H_1**: As a result of the 12-week yoga-based intervention, participants in the yoga group will demonstrate significant improvement in COFL, and improvement in alternative flexibility and control flexibility over time, as measured by the CFI, compared to controls.
>
> **H_2**: There will be no significant difference in COFL over time, as measured by the CFI, between age groups (25-35 vs. 35-45 years) of the yoga group as a result of the 12-week yoga-based intervention.

H_3: There will be a more significant increase of COFL over time, as measured by the CFI, in male subjects than in female subjects of the yoga group as a result of the 12-week yoga-based intervention.

RQ2: Is there a difference in Locus of Control (LOC) after implementing the 12-week yoga-based intervention, as measured by the Levenson's IPC Scale, between the yoga and control groups over time?

H_4: As a result of the 12-week yoga-based intervention, there will be a significant movement towards a more internal locus of control and a significant decrease in the Powerful others and Chance LOC subdimension, for the yoga group over time.

H_5: There will be no significant difference in LOC subdimensions over time, as measured by the Levenson's IPC Scale, between age groups (25-35 vs. 35-45 years) of the yoga group as a result of the 12-week yoga-based intervention.

H_6: There will be no significant difference in LOC subdimensions over time, as measured by the Levenson's IPC Scale, between male and female subjects of the yoga group as a result of the 12-week yoga-based intervention.

RQ3: Is there a difference in Emotion Regulation (ER) after implementing the 12-week yoga-based intervention, as measured by the ERQ, between the yoga and control groups over time?

H_7: As a result of the 12-week yoga-based intervention, participants in the yoga group will demonstrate a significant increase in cognitive reappraisal and a significant decrease in expressive suppression over time, as measured by the ERQ, compared to controls.

H_8: There will be no significant difference in ER subdimensions, i.e. cognitive reappraisal and expressive suppression, over time, as measured by the ERQ, between age groups (25-35 vs. 35-45 years) of the yoga group as a result of the 12-week yoga-based intervention.

H_9: Female subjects of the yoga group will experience a greater increase in cognitive reappraisal than male subjects of the yoga group over time, whereas male subjects of the yoga group will experience a greater decrease in expressive suppression than female subjects of the yoga group over time, as measured by the ERQ, as a result of the 12-week yoga-based intervention.

RQ4: Is there a difference in Work Engagement (WE) after implementing the 12-week yoga-based intervention, as measured by the UWES-3, between the yoga and control groups over time?

H_{10}: As a result of the 12-week yoga-based intervention, participants in the yoga group will demonstrate significant improvement in work engagement over time, as measured by the UWES-3, compared to controls.

RQ5: Is there a difference in Work-Related Rumination (WRR) after implementing the 12-week yoga-based intervention, as measured by the WRRQ, between the yoga and control groups over time?

H_{11}: As a result of the 12-week yoga-based intervention, participants in the yoga group will demonstrate significant decrease in both affective rumination and problem-solving pondering over time, as measured by the WRRQ, compared to controls.

RQ6: Is there a difference in Sleep Quality after implementing the 12-week yoga-based intervention, as measured by the PSQI, between the yoga and control groups over time?

H_{12}: As a result of the 12-week yoga-based intervention, participants in the yoga group will demonstrate a significant improvement in sleep quality, i.e. significant decrease of the Global PSQI Score over time, as measured by the PSQI, compared to controls.

Furthermore, effects of the intervention will be maintained at three months, in comparison to the baseline scores, with:

- a significant improvement in COFL (**H_{13}**),
- a significant movement towards a more internal locus of control (**H_{14}**),
- a significant increase in cognitive reappraisal and a significant decrease in expressive suppression (**H_{15}**),
- a significant improvement in work engagement (**H_{16}**),
- a significant decrease in affective rumination and problem-solving pondering (**H_{17}**), and
- a significant improvement in sleep quality (**H_{18}**).

CHAPTER V

METHODOLOGY

In this chapter, the methodology, variables and tools (instruments) used are explained. The present research study was carried out online, under the guidance of Dr. K. Krishna Sharma, Chairman of the Department of Human Consciousness and Yogic Sciences, Mangalore University, Mangalagangothri, Karnataka. The main objective of the study was to assess the effects of selected yogic practices on cognitive flexibility, locus of control and emotion regulation, work engagement, work-related rumination and sleep quality of IT professionals in India. Totally 158 subjects working in the IT sector in Bengaluru, India, age group 25 to 45 years were considered eligible for this study. They were ready to be the part of this study and informed written consent was obtained from them. They were randomized into two groups, i.e. yoga (experimental) and control with 79 subjects each. The control group continued with their normal lifestyle. The yoga (experimental) group was provided classes with selected yogic practices, two days per week for duration of one hour, for 12 weeks. These practical sessions employed a standard sequence of selected asanas, pranayamas and relaxation techniques, taking appropriate precaution and giving individual attention.

Participant selection criteria

Participant inclusion criteria were:

1. IT professionals working for companies based in Bangalore City, Karnataka, India
2. Both genders
3. Age range: 25-45 years
4. No physical activity for the last 6 months, counting till the date of beginning of the study
5. Not relocating during 3 months from the date of beginning of the study
6. Able to read / understand / speak English
7. Regular and stable Internet access, via mobile phone, desktop/laptop computer, tablet etc.
8. Individuals willing to participate in the research study
9. Individuals willing to be randomized.

Participant exclusion criteria were:

1. Known pregnancy
2. Individuals with pre-existing medical problems (non-diabetic, non-hypertensive), cardiac problems, endocrinal diseases, psychiatric disorders
3. Individuals who had surgery within 6 months prior to the date of beginning of the study
4. Individuals who are on any medication that grossly affects the sleep (e.g. central nervous system stimulants, sedatives, steroids, amphetamines, benzodiazepines)
5. Individuals indulging in tobacco chewing, smoking, alcohol and drug use.
6. Individuals not willing to participate in the research study.

Attendance

Each participant had to attend at least 75% of intervention sessions, i.e. 18 out of 24 sessions, to be retained in the study and had answer all questionnaires at all data collection time points. In order to mark their attendance, participants were asked to keep their videos on throughout the entire session.

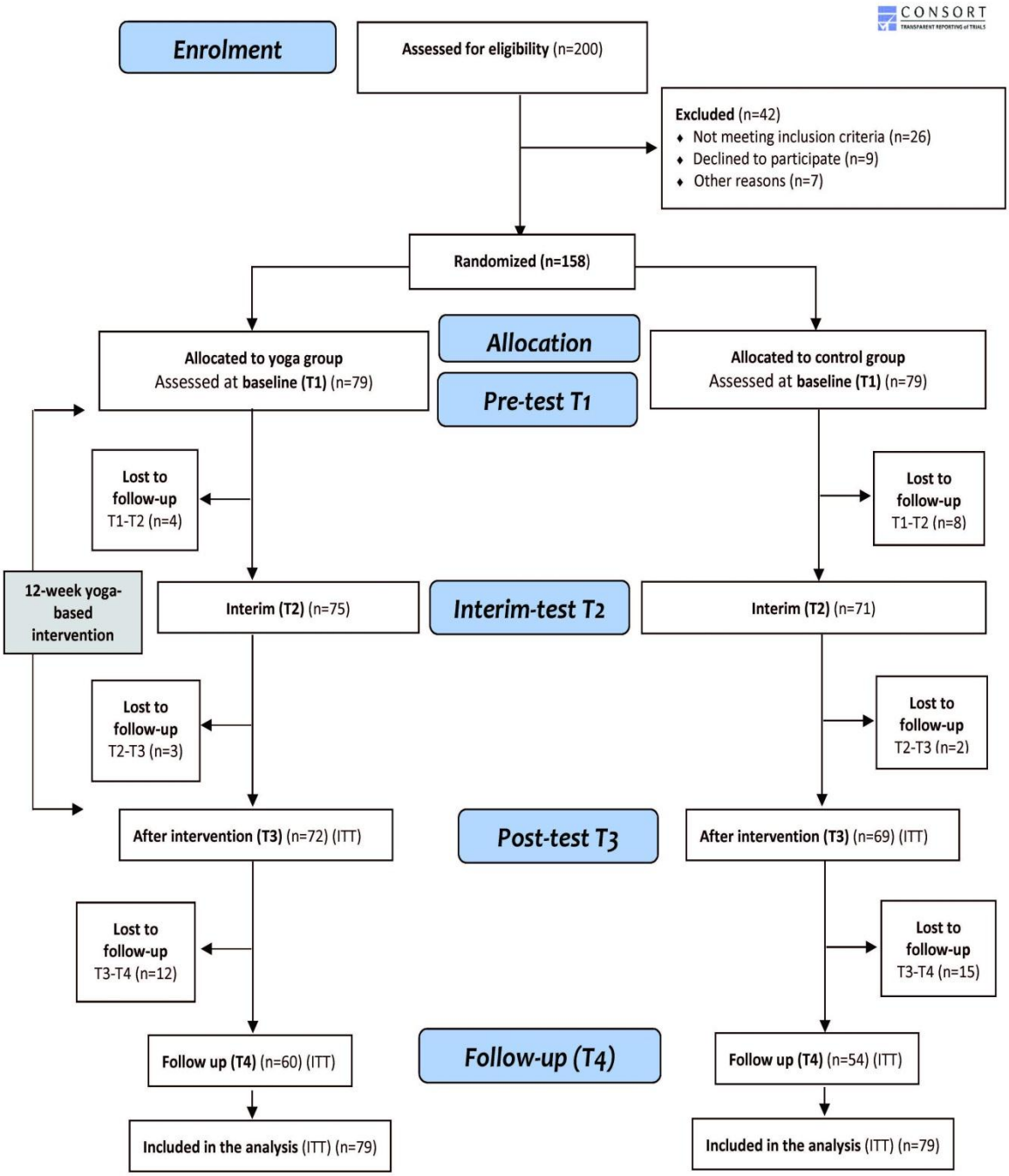
Study design

This study used a randomized control trial design comparing pre-, interim-, post-intervention and follow-up scores between and within groups on validated outcome measures. This study employed a 2X4 factorial design, i.e., two factors (yoga and control group) each at 4 levels (pre-, interim-, post-, follow-up). Assessment time was the within-subjects independent factor, and the group in which participants were allocated to (yoga vs. control) was the between-subjects independent factor. All questionnaires were measured at baseline (T1), interim (T2), post-intervention (T3) and follow-up (T4). Our study data showed the attrition rate of 8.86%, round-off to 9%.

Table 5.1. Baseline sociodemographic and work characteristics of the study participants

Characteristic	Participants			p Value	Cohen's d
	All (N=158)	Yoga(N=79)	Control (N=79)		
Age					
Mean (SD)	34.67(5.56)	34.32(5.58)	35.03(5.55)	p =0.399 T =-0.8438	0.25
25-35	88 (55.69%)	48 (60.75%)	40 (50.63%)		
35-45	70 (44.31%)	31 (39.24%)	39 (49.36%)		
Gender					
Male	95(60.12%)	49 (62.02%)	46 (58.22%)	$\chi 2$=0.2141 p= 0.6435	0.34
Female	63(39.88%)	30 (37.97%)	33 (41.77%)		
Marital status					
Single	29 (18.35%)	16 (20.25%)	13 (16.45%)	$\chi 2$=0.3099 p =0.8564	0.62
Married / de facto	127 (80.38%)	62(48.48%)	65(82.27%)		
Separated/divorced/widowed/unknown/other	2 (1.14%)	1 (1.26%)	1 (1.26%)		
Living status					
Alone	23 (14.55%)	11 (13.92%)	12 (15.19%)	$\chi 2$ =4.9285 p=0.1771	0.12
With spouse or partner	65 (41.13%)	37 (46.83%)	28 (35.44%)		
Living in shared flat / PG	6 (3.79%)	5 (6.32%)	1 (1.26%)		
With parents	64 (40.51%)	26 (32.91%)	38 (48.10%)		
Education level					
Bachelor	128 (81.01%)	60 (75.94%)	68 (86.07%)	$\chi 2$=2.2713 p=0.3212	0.16
Master	21 (13.29%)	14 (17.72%)	7 (8.88%)		
Other	9 (5.69%)	5 (6.32%)	4 (5.06%)		
Working experience (total)					
Mean (SD)	8.73(4.98)	8.56(5.20)	8.90(4.78)	p =0.6497 T = -0.4549	0.82
1-10	103 (65.19%)	53 (67.08%)	50 (63.29%)		
10-20	55 (34.81%)	26 (32.91%)	29 (36.70%)		
Working experience with the current employer					
Mean (SD)	3.29(1.58)	3.26(1.56)	3.33(1.61)	p = 0.7755 T = -0.2856	0.24
0-3	101 (63.92%)	51 (64.55%)	50 (63.29%)		
4-7	49 (31.01%)	24 (30.38%)	25 (31.64%)		
7+	8 (5.06%)	4 (5.06%)	4 (5.06%)		
Job title					
Software Analyst	43 (27.21%)	21 (26.58%)	22 (27.84%)	$\chi 2$=4.9285 p=0.5530	0.49
Software Architect	7 (4.43%)	4 (5.06%)	3 (3.79%)		
Software Developer	14 (8.86%)	9 (11.39%)	5 (6.32%)		
Software Engineer	56 (35.44%)	26 (32.91%)	30 (37.97%)		
Data Scientist	8 (5.06%)	5 (6.32%)	3 (3.79%)		
IC designer	23 (14.55%)	13 (16.45%)	10 (12.65%)		
Other	7 (4.43%)	3 (3.79%)	4 (3.48%)		
Working hours per week					
Mean (SD)	45.95(4.20)	45.97(4.34)	45.94(4.09)	p= 0.9570 T= 0.0539	0.46
<40 hours	8 (5.06%)	4 (5.06%)	4 (5.06%)		
40-50 hours	135 (85.44%)	64 (81.01%)	71 (89.87%)		
51-60 hours	15 (9.49%)	10 (12.65%)	5 (6.32%)		

Figure 5.1. Participant Study Flow adapted from the CONSORT 2010 Flow Diagram



The following yogic practices were taught to yoga (experimental) group:

Svastikasana, Vajrasana, Supta vajrasana, Tadasana I, Trikonasana, Parsvakonasa, Pascimottanasana, Purvothanasana, Pavanamuktasana, Bhujangasana, Shalabhasana, Dhanurasana, Upavistakonasana, Baddhakonasana, Bharadwajasana, Viparitakarani, Halasana, Ujjayee, Anuloma Viloma, Bhastrika, Bahyakumbhaka, Pranava dhyana, Shavasana/Yoganidra.

Variables and Tools

Table 5.3. Outcomes and outcome measures used in the study

	VARIABLE	**TOOL**	**DIMENSIONS / SUBSCALES**
CO-PRIMARY OUTCOMES	COGNITIVE FLEXIBILITY (COFL)	COGNITIVE FLEXIBILITY INVENTORY (CFI)	1. Alternative flexibility 2. Control flexibility
	LOCUS OF CONTROL (LOC)	LEVENSON'S IPC SCALE	1. Internality 2. Powerful Others 3. Chance
	EMOTION REGULATION (ER)	EMOTION REGULATION QUESTIONNAIRE (ERQ)	1. Cognitive Reappraisal 2. Expressive Suppression
SECONDARY OUTCOMES	WORK ENGAGEMENT	UTRECHT WORK ENGAGEMENT SCALE–3 (UWES-3)	1. Vigor 2. Dedication 3. Absorption
	WORK-RELATED RUMINATION	WORK-RELATED RUMINATION QUESTIONNAIRE (WRRQ)	1. Affective Rumination 2. Problem-Solving Rumination 3. (Detachment)
	SLEEP QUALITY	PITTSBURGH SLEEP QUALITY INDEX (PSQI)	Only General PSQI score taken for this study.

Repeated Measures Analysis of Variance (RM-ANOVA) was used to compare within and between the two groups. As in both groups (yoga and control) participants were lost to follow-up, between various time points, and Intention-To-Treat (ITT) Analysis was used to calculate the missing values.

CHAPTER VI

RESULTS

In this chapter results of the overall study are described. In total, 25 % of data was missing at different time periods and missing observations were handled using mean imputation. For the four different time periods (pre, interim, post and follow-up), normality tests were done and resulted in not rejecting the null hypothesis. Hence, four different datasets are normally distributed and we proceeded with parametric analysis. To check the internal consistency reliability of all questionnaires used, Cronbach's alpha (α) coefficients were calculated for the pre data for each variable. Alpha levels for all questionnaires were near to 0.7 and all were above 0.5, showing internal consistency reliability of all questionnaires used to carry out the study. Hence, same questionnaires were used for the next three time periods and responses were collected. Table 6.1. presents Cronbach's alpha of the study questionnaires. Correlations of all study variables at baseline are reported in Table 6.2. The correlation of variables are non-significant for most variables. Means and standard deviations of all study variables at all time points, split by groups, are reported in Table 6.3.

Table 6.1. Cronbach's alpha of the study questionnaires

Variable	Cronbach's alpha
COFL Total	0.7078
Alternative Flexibility	0.8116
Control Flexibility	0.7046
Internality	0.8416
Powerful Others	0.7981
Chance	0.8345
Cognitive Reappraisal	0.6857
Expressive Suppression	0.7434
Work Engagement	0.8038
Vigor	0.8164
Dedication	0.8315
Absorption	0.7636
Affective Rumination	0.7834
Problem-Solving Pondering	0.6971
Sleep Quality	0.7957

Table 6.2. Correlations for all study variables at the baseline

	Cognitive Flexibility	Alternative Flexibility	Control Flexibility	Internality	Powerful others	Chance	Cognitive Reappraisal	Expressive Suppression	Work Engagement	Affective Rumination	Problem-Solving Pondering	Global PSQI
Cognitive Flexibility	1.00000	-	-	-	-	-	-	-	-	-	-	-
Alternative Flexibility	0.92974	1.00000	-	-	-	-	-	-	-	-	-	-
Control Flexibility	0.31648	-0.05504	1.00000	-	-	-	-	-	-	-	-	-
Internality	0.01983	0.03961	-0.04828	1.00000	-	-	-	-	-	-	-	-
Powerful others	-0.17288	-0.08677	-0.24524	-0.06164	1.00000	-	-	-	-	-	-	-
Chance	-0.15284	-0.15993	-0.00242	0.13422	-0.00672	1.00000	-	-	-	-	-	-
Cognitive Reappraisal	0.01228	0.01398	-0.00273	0.21670	0.13866	0.01048	1.00000	-	-	-	-	-
Expressive Suppression	-0.13502	-0.14515	0.00781	-0.18396	-0.23981	0.04802	-0.06542	1.00000	-	-	-	-
Work Engagement	-0.10616	-0.07503	-0.0945	0.06086	0.04492	-0.01990	-0.25015	-0.13705	1.00000	-	-	-
Affective Rumination	0.01024	0.05768	-0.12083	-0.07154	-0.02423	0.06596	0.06786	-0.07545	0.07463	1.0000	-	-
Problem-Solving Pondering	0.20912	0.12889	0.2350	-0.04030	0.08248	0.09218	-0.17496	-0.29738	0.05708	0.02218	1.00000	-
Global PSQI	0.01777	0.07685	-0.14980	0.21897	0.00795	0.11971	-0.02306	-0.05525	-0.00799	-0.01747	0.05377	1.00000

Table 6.3. Descriptive statistics: Means and standard deviations (SD) for outcome variables across all time points, split by group (yoga or control)

Variable	Yoga group (n=79) mean (SD)				Control group (n=79) mean (SD)				t	p-value
	Baseline (T1)	Interim (T2)	Post (T3)	Follow-up (T4)	Baseline (T1)	Interim (T2)	Post (T3)	Follow-up (T4)		
Cognitive Flexibility	101.65 (14.79)	105.37 (13.24)	111.15 (12.75)	110.56 (10.35)	100.65 (12.36)	101.27 (15.36)	102.9 (16.14)	99.68 (10.37)	-4.21	0.00043
Alternative Flexibility	67.17 (8.43)	74.31 (5.42)	78.81 (4.37)	77.29 (5.61)	65.75 (7.29)	65.81 (6.97)	67.58 (5.97)	65.41 (6.24)	-10.34	<0.0001
Control Flexibility	45.61(7.64)	51.27 (7.10)	65.1 (4.65)	63.72 (5.88)	44.57 (4.57)	45.24 (7.51)	46.69 (5.47)	45.6 (6.13)	-18.51	0.0029
Internality	31.54 (4.73)	33.60 (4.7)	38.15 (5.13)	36.12 (7.05)	32.44 (3.47)	31.85 (5.73)	33.19 (4.63)	32 (2.99)	-8.31	0.0064
Powerful Others	25.74 (7.14)	23.14 (4.82)	19.65 (2.28)	15.52 (5.95)	24.37 (5.24)	23.8 (6.15)	22.71 (4.52)	23.47 (6.01)	6.76	0.0057
Chance	27.54 (6.57)	24.68 (5.14)	18.25 (2.41)	17.53 (4.52)	28.62 (5.41)	27.34 (3.79)	26.17 (3.85)	25.09 (4.38)	11.08	<0.001
Cognitive Reappraisal	24.58 (6.16)	26.43 (6.21)	30.71 (5.94)	29.65 (5.36)	25.87 (4.34)	26.34 (6.32)	26.86 (5.34)	27.72 (4.26)	-6.24	0.007
Expressive Suppression	17.5 (6.34)	15.27 (4.35)	14.28 (1.49)	12.89 (5.09)	16.89 (5.5)	16.14 (6.37)	15.76 (5.9)	17.59 (4.37)	4.09	0.00034
Work Engagement	3.56 (1.23)	4.89 (2.12)	6.52 (1.62)	6.32 (2.75)	3.97 (1.23)	4.89 (3.42)	4.72 (3.87)	4.2 (2.75)	-12.93	0.0067
Vigor	3.3 (1.4)	4.6 (2.34)	6.1 (1.5)	5.9 (2.4)	4.3 (2.1)	3.8 (3.19)	4.1 (3.41)	3.87 (2.4)	-11.97	0.021
Dedication	4.1 (1.3)	5.18 (1.51)	7.36 (1.7)	6.97 (3.1)	3.49 (1.4)	4.2 (1.94)	4.8 (3.58)	4.9 (3.1)	-13.53	0.016
Absorption	3.3 (1.5)	4.9 (2.1)	6.1 (1.1)	6.09 (2.6)	3.76 (1.34)	3.94 (4.97)	5.24 (4.01)	6.09 (2.6)	-12.91	0.037
Affective Rumination	20.18 (2.90)	16.46 (4.74)	13.8 (4.80)	13.54 (3.27)	19.27 (3.45)	19.78 (2.67)	21.39 (5.85)	20.48 (4.68)	10.23	<0.0001
Problem-Solving Pondering	18.35 (2.72)	15.49 (2.87)	12.5 (2.17)	12.81 (3.81)	19.57 (1.58)	18.6 (3.47)	18.1 (2.46)	17.15 (5.64)	14.49	<0.0001
Global PSQI Score	6.48 (3.84)	5.37 (4.85)	3.83 (3.01)	4.02 (2.94)	6.35 (1.85)	6.17 (2.21)	5.94 (3.91)	6.13 (1.6)	4.98	<0.001

The main study hypotheses were tested using an independent two sample t-test between the two groups to compare the pre to post change, and pre to FUP change, in scores in the intervention group with the pre to post change, and pre to FUP change, in scores in the control group (Table 6.4.).

Table 6.4. Study hypotheses testing

Variable	Test statistic	p-value	Effect size d
H1: COFL exp and ctrl	t (139) = 7.2564	<0.001*	0.59
Alternative flexibility	t (139) = 3.9467	0.0014	0.27
Control flexibility	t (139) = 11.4661	<0.001	0.61
H2: COFL between age groups (exp)	t (77) = 2.0161	0.0861	0.06
H3: COFL males, females (exp)	t (77) = 6.546	<0.001*	0.72
H4: LOC (exp and ctrl)			
Internality	t (139) = 6.30819	<0.001*	0.41
Powerful others	t (139) = -4.2612	0.0234	0.13
Chance	t (139) = -3.9721	0.0094	0.27
H5: LOC age groups (exp)			
Internality	t (77) = 0.9063	0.1348	0.04
Powerful Others	t (77) = 0.3922	0.0613	0.17
Chance	t (77) = 0.0251	0.0568	0.078
H6: LOC male; female (exp)			
Internality	t (77) = 0.8370	0.7543	0.018
Powerful Others	t (77) = 0.3771	0.3655	0.24
Chance	t (77) = 0.5501	0.0562	0.19
H7: CR (exp and ctrl)	t (139) = 5.8996	<0.001*	0.46
ES (exp and ctrl)	t (139) = - 7.0843	0.0267	0.37
H8: ER: age groups of yoga (exp)			
CR age groups of yoga (exp)	t (77) = 1.5924	0.5010	0.34
ES age groups of yoga (exp)	t (77) = 2.6751	0.1884	0.49
H9: CR female; male (exp)	t (78) = 9.4286	<0.001*	0.36
ES Male; female (exp)	t (78) = - 8.4538	<0.001*	0.27
H10: UWES-3 (exp and ctrl)	t (139) = 7.4431	<0.001*	0.48
H11: Work-Related Rumination			
Affective Rumination (exp and ctrl)	t (139) = -6.1792	<0.001*	0.58

Problem-Solving Pondering (exp and ctrl)	t (139) = -5.8846	0.01562	0.12
H12: PSQI SCORE (exp and ctrl)	t (139) = -7.8041	<0.001*	0.68
H13: COFL	t (112) = 6.2997	<0.001*	0.27
H14: Internal locus of control	t (112) = 8.5371	<0.001*	0.34
H15: Increase in cognitive reappraisal	t (112) = 7.6482	<0.001*	0.49
H16: Decrease in expressive suppression	t (112) = -9.6512	<0.001*	0.51
H17: Improvement in work engagement	t (112) = 8.4634	<0.001*	0.67
H18: Decrease in affective rumination	t (112) = -9.2451	<0.001*	0.21
H19: Decrease in problem-solving pondering	t (112) = -7.6129	<0.001*	0.43
H20: Improvement in sleep quality	t (112) = -6.4152	<0.001*	0.67

Repeated Measures Analysis of Variance (RM-ANOVA) was used to compare within and between the two groups. The ANOVA values for the Within-Subjects factors (States; pre, interim, post, follow-up), Between-Subjects factors (Groups: yoga and control) and interaction between the two for different variables in Table 6.5. and explained below.

Table 6.5. Details of the ANOVA

Sl. no.	Factors	Variable	*F*	*df*	Huynh-Feldt ε	*p* value
I	Within Subjects (States)	Cognitive Flexibility	9.2941	158	1	<0.001
		Alternative Flexibility	4.4125	158	1	<0.001
		Control Flexibility	3.9221	158	1	0.0341
		Internality	4.3164	158	1	<0.001
		Powerful Others	9.0323	158	1	0.0037
		Chance	6.2837	158	1	0.0162
		Cognitive Reappraisal	2.8057	158	1	0.0348
		Expressive Suppression	3.0517	158	1	0.0421
		Work Engagement	4.5952	158	1	<0.001
		Affective Rumination	9.9841	158	1	<0.001
		Problem-Solving Pondering	5.3024	158	1	<0.001
		Global PSQI Score	6.2929	158	1	<0.001
II	Between Subjects (Groups)	Cognitive Flexibility	7.7767	158	1	<0.001
		Alternative Flexibility	5.5940	158	1	0.0019
		Control Flexibility	4.8414	158	1	0.0032
		Internality	12.6675	158	1	<0.001
		Powerful Others	2.1151	158	1	0.0981
		Chance	4.9747	158	1	0.0142
		Cognitive Reappraisal	8.0029	158	1	<0.001
		Expressive Suppression	7.5681	158	1	0.0151
		Work Engagement	8.8867	158	1	<0.001
		Affective Rumination	3.1074	158	1	<0.001
		Problem-Solving Pondering	4.2465	158	1	<0.001
		Global PSQI Score	5.826	158	1	<0.001
III	States × Groups	Cognitive Flexibility	1.862	158 (States) × 2 (Groups)	1	0.6715
		Alternative Flexibility	2.0516	158 (States) × 2 (Groups)	1	0.0198
		Control Flexibility	1.1934	158 (States) × 2 (Groups)	1	0.2476
		Internality	4.4512	158 (States) × 2 (Groups)	1	0.0252
		Powerful Others	1.3092	158 (States) × 2 (Groups)	1	0.3476
		Chance	6.7936	158 (States) × 2 (Groups)	1	<0.001
		Cognitive Reappraisal	2.1556	158 (States) × 2 (Groups)	1	0.1612
		Expressive Suppression	1.3137	158 (States) × 2 (Groups)	1	0.0657
		Work Engagement	7.1455	158 (States) × 2 (Groups)	1	0.0209
		Affective Rumination	2.8952	158 (States) × 2 (Groups)	1	0.0347
		Problem-Solving Pondering	4.3321	158 (States) × 2 (Groups)	1	0.0437
		Global PSQI Score	2.8205	158 (States) × 2 (Groups)	1	0.0274

CHAPTER VII

DISCUSSIONS

In this chapter study results are discussed. The yoga intervention resulted in significant short-term benefits (after 12 weeks) that were maintained in the long-term (at the end of the 12-week follow up, i.e. after 24 weeks from the baseline). Furthermore, it was effective in the increase of alternative flexibility and control flexibility, cognitive reappraisal, work engagement, decrease of expressive suppression, affective rumination and problem-solving pondering, and improvement in sleep quality, when compared with controls. All improvements maintained at the three month follow-up, suggesting that yoga interventions could have long term benefits for employees and employers.

Strengths of the study:

- Data was collected at the interim and at the follow-up
- A sample size of 158 participants from varying educational and working experience backgrounds provides reasonable generalizability of findings

Limitations and Future Research:

- Firstly, selection bias may arise as study participants were enrolled through convenience sampling, i.e. they were self-enrolled. Although participants in this study met eligibility criteria and were group randomized, it was a volunteer sample interested in yoga. Hence, there is a possibility that the positive results are an artefact of a highly motivated group of individuals, i.e. results should not be generalized, as yoga may not be appealing and effective for all IT professionals.
- Secondly, the study did not ask for participant's previous experience of meditation, mindfulness or yoga practice as it was not an exclusion criteria (the only related criteria was no activity for 6 months prior to the study beginning). However, without controlling for this, it is possible that there were inherent differences in the groups which were not known.

- Furthermore, the control group in this study is not an active control group, meaning the effects that were found could reflect a general treatment effect. An active control group, such as walking, gym, football or pilates/aerobics, of similar frequency and duration, including similar amount of interaction with an instructor, is recommended for future research, as it may further reduce the overall difference in the scores of both the groups.

- The majority of participants (60.12%) were male. Thus, findings may not be generalizable to female IT professionals, and potential gender differences require further investigation.

- The next methodological limitation was the reliance on self-report data in this study. Additionally to the self-report data, various other measures could be included, e.g. a measure of individual changes in participants' wellbeing, such as the use of employees' sickness data or using pre-post measures of changes noticed by others who know the participants. Also, for some of the variables pen and pencil/computerized tests could be used and for some even biochemical parameters, biomarkers and neuroimaging are recommended.

- Further investigation of other potential factors that may affect outcomes, such as changes in diet, social engagement, significant life events, job promotion, salary increase, phase of the project, is also recommended.

- Future research needs to investigate the long-term sustainability of the yoga program benefits, as part of workplace wellness programs, for both the employees and the organizations. It is recommended to collect longer term follow-up data up to 6 or 12 months after the intervention, to measure the stability of the post intervention effects.

- The present yoga program took place on workdays, out of office hours, i.e. during IT professionals' free time. It is recommended to research the effectiveness of a yoga program incorporated in the workplace practice (e.g. as sessions during lunch breaks or short power breaks throughout the day), so that wellness and well-being become an integral part of work life.

- Furthermore, comparisons of yoga programs conducted in different parts of the day (morning / afternoon / late evening) and week (workdays/weekend) might provide

more insight into the IT professionals' interest in yoga programs, and benefits of those programs for their health, well-being and performance.

- This study included only individual outcomes, i.e. intrapersonal variables of an employee. Future studies should aim at including workplace outcomes, i.e. interpersonal parameters, such as measures of cooperation, group atmosphere and quality of organizational climate.

- Further to the limitations outlined above it would be beneficial to develop a research design to address some of the methodological limitations regarding the ways of motivating employees to join yoga sessions, such as offering perks for regular attendance.

- Benefits on all measures were maintained or continued to improve at a 12-week follow-up period. As many IT professionals have periods of many days or even weeks without hardly any free time, it is recommended to investigate further, about the maximum period without yoga practice or with irregular yoga practice, in order to discover the time point when the benefits start diminishing. Further investigation of effective amounts of yoga practice for the population of IT professionals is recommended.

Practical implications:

- The results of this study may provide some insight into helping IT professionals deal with the emotional demands of their profession in a positive manner, improve their cognitive flexibility and hence their multitasking abilities, and believe more that they themselves are in charge of their progress and career, thus leading to an improved workplace environment.

- The findings from this study can be used to inform Workplace Wellness Programs (WWPs), especially because organizations are searching for holistic approaches to their WWPs, beyond typical gym memberships and lunch break massage sessions.

CHAPTER VIII

CONCLUSIONS

The present study has shown that within 12 weeks yoga-based intervention improves cognitive flexibility, emotion regulation, shifts locus of control more to the internal, improves work engagement and sleep quality, and reduces work-related rumination of IT professionals. Results showed that all improvements maintained at the three month follow-up, suggesting that yoga interventions could have long term benefits for employees and employers.

These findings suggest that yoga practice is an effective option for IT professionals to improve multitasking skills, feel more in control over their life and career, manage their emotions in a better way, think less negative about their job and work settings, feel more engaged with their work, and sleep better.

IT employers could consider integrating yoga classes into future corporate health and well-being promotion programs on a larger scale, to enhance the health and well-being of their workforce. Programs which improve workplace well-being and performance are important for employee well-being and mental health, and positively impact organizations and the society as a whole.

Publications:

1. Ciganovic, Z., Sharma, K.K.. **Impact of a Yoga-Based Intervention on Emotion Regulation in IT Professionals**. (April 2022) International Journal of Yoga and Allied Sciences, Indian Association of Yoga, ISSN: 2278 – 5159
2. Ciganovic, Z., Sharma, K.K.. **Importance of Yoga for Health and Well-Being of IT Workforce in the New Normal: A Narrative Review.** (March 2022) Journal of Management Studies and Academic Research, published by SDM College of Business Management, PG Centre for Management and Research, Mangaluru, ISSN: 2455-4960
3. Ciganovic, Z., Sharma, K.K.. **Employee Locus of Control: A Bibliometric Analysis and Visualization of the Scientific Landscape**. (December 2021). International Journal of Research on Social and Natural Sciences, published by Katwa College, Burdwan, West Bengal, India, eISSN: 2455-5916

Conference paper presentations:

1. Ciganovic, Z. (2021, August 08-07). **Yoga in Occupational Settings: A Bibliometric Analysis** [Paper presentation]. Yogastha Conference, organized by Indian Institute of Technology Bombay (IIT-B), India
2. Ciganovic, Z., Sharma, K.K., (2021, May 21-23). **The Potential of Corporate Yoga in Enhancement of Emotion Regulation in IT Workforce in the New Normal: A Brief Narrative Review** [Paper presentation]. International Conference on Consciousness-Based Leadership and Management, **Maharishi International University**, Fairfield, Iowa, USA**;**
3. Ciganovic, Z., Sharma, K.K., (2020, August 27-28). **Software Developers' Locus of Control during the COVID 19 Pandemic** [Paper presentation]. International E Conference on "Tackling Opportunities and Vulnerabilities During the Pandemic Techno and Human Approaches", organized by SDM College of Business Management Post Graduate Centre for Management Studies and Research, Mangaluru, India
4. Ciganovic, Z., Sharma, K.K., (2020, August 27-28). **Impact of Working from Home on Software Development Professionals' Mental Wellbeing and Productivity during the COVID 19 Pandemic: A Narrative Review** [Paper presentation]. International E Conference on "Tackling Opportunities and Vulnerabilities During the Pandemic Techno

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7. Ciganovic, Z., Sharma, K.K., (2020, June 25-26). **Yogic Solutions for Employee Wellbeing for Indian ICT MSMEs in the Post COVID-19** [Paper presentation]. International Virtual Conference on Retrospect and Prospects of MSMEs in the Post COVID 19, School of Tribal Resource Management, Kalinga Institute of Social Sciences (KISS), Deemed to be University, Bhubaneswar-751024, Odisha, India
8. Ciganovic, Z., Sharma, K.K., (2020, June 17-18). **Emergence of Yoga as a Successful Set of Tools for Improving Employee Wellbeing in the New Normal** [Paper presentation]. Online International Conference on "New Normal: Corporate and Self-Management in Current Scenario", School of Management, Gautam Buddha University, Greater Noida, India
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